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Google Jamboard for virtual anatomy education

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Educational adaptions in a pandemic

The need for innovative teaching tools for the anatomy educator has dramatically amplified amidst the COVID-19 pandemic.[1] Social distancing protocols have suddenly tasked educators around the globe with developing an online curriculum capable of compensating for the loss of in-person, lab-based instruction on which it traditionally so strongly relies. Through this transition, it is important for educators to prioritise a collaborative and cohesive online learning environment. Indeed, reduced student engagement and diminished student–teacher interactions were identified as primary threats to a student's educational experience in the early stages of the pandemic by researchers in the United Kingdom and Republic of Ireland.[2] Australian students reported similar trepidations in the face of COVID-19, aware of potential educational shortcomings that are likely to accompany the sacrifice of peer-to-peer interactions.[3] Recognising these impending pressures, Evans and colleagues implored anatomy educators to engage students with 'intuitive interaction' through the creative use of technological assets.[4] Educators have done well in rising to this challenge, employing various video conferencing platforms[5] and web-based tools[1] to support online learning. There are, however, inherent monetary and functionality barriers to each that must be considered. Perhaps most importantly, these implements are largely limited in their cooperative capacity, hindering the promotion of congenial student relations. The rapid transition to remote teaching has therefore highlighted the need for an affordable and accessible online tool specialised in supporting a collaborative learning space that could be used through the pandemic and beyond.

An affordable and accessible online tool specialised in supporting a collaborative learning space.

Google Jamboard

Jamboard is a web-based whiteboard system that was initially released in 2017 as a hardware and software combination incorporating a 55" touchscreen display and an annual support fee. The web application underpinning this hardware system is freely available at https://jamboard.google.com/ via the G Suite of cloud applications and allows real-time co-authoring using a browser on any laptop, tablet or smartphone. There are also Android and iOS applications available that allow for access and editing of presentations.

A new Jamboard is easily created and will be automatically stored and updated in the user's Google drive. Each can consist of up to 20 slides, which may serve as a collaborative whiteboard simultaneously up to 50 editors. To share a Jamboard with a student group, the instructor should first duplicate the master version, and then in the new copy they should select the sharing option which allows the editor access to anyone with the link. The Jamboard must be duplicated so that there is a separate version for each individual group of students and only the mark-up from one group is visible to each student. The tools available to mark up a Jamboard include a pen tool, highlighter, eraser, shape tool and text box

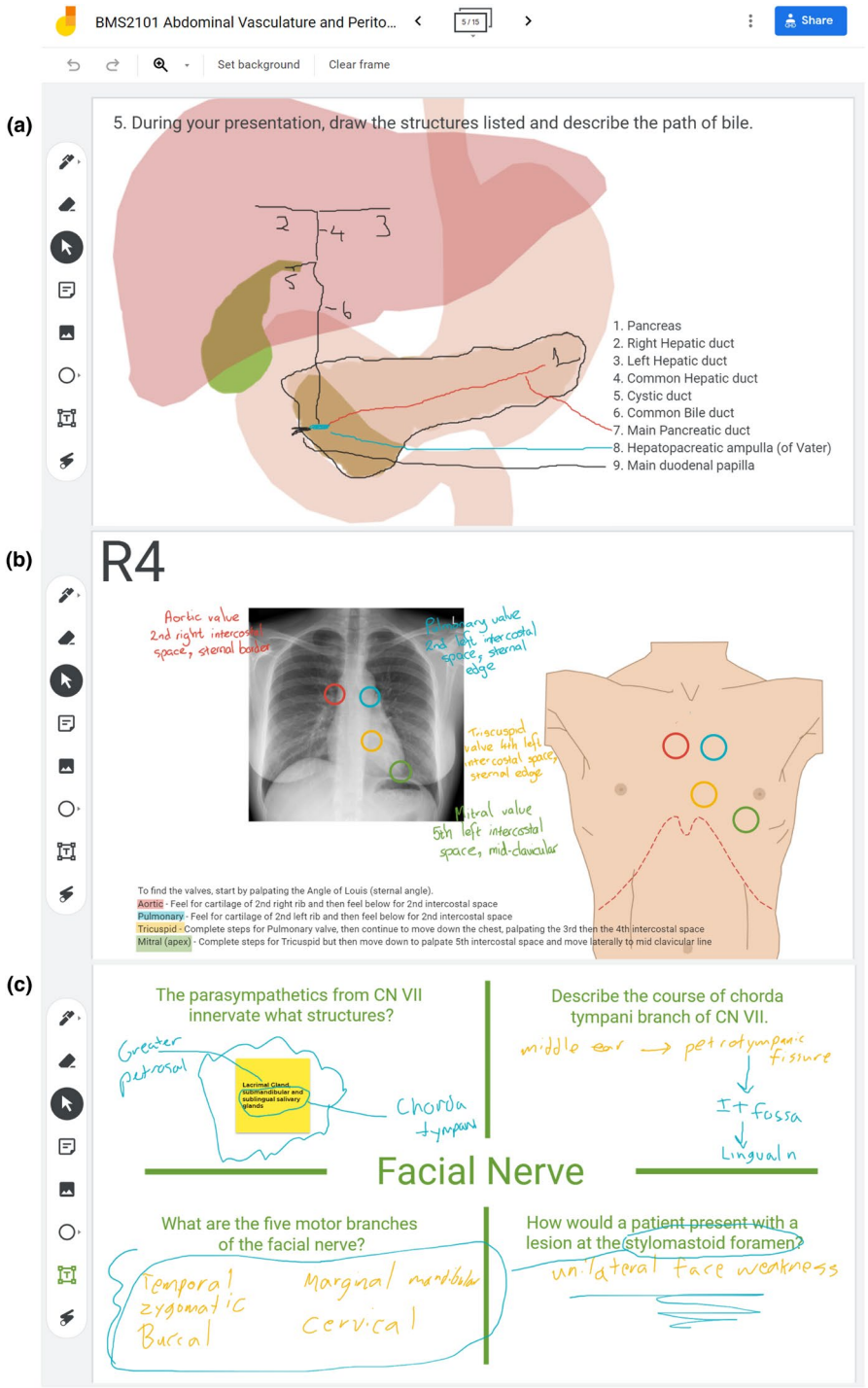

FIGURE 1 Examples of Jamboard slides. A: A template design exemplar from Queen's University Belfast, consisting of a diagram and list of structures. Students annotate using these labels during the session. B: An exemplar presentation slide from University of Dundee created by students using provided images. C: An example from Lincoln Memorial University DeBusk College of Osteopathic Medicine, students used the pen, sticky note, or text box features to provide answers to each question

(Figure 1). Additionally, there is a laser pointer tool which leaves an impermanent mark on the Jamboard visible to all participants for several seconds. Images can be pasted in from other sources and basic manipulations such as resizing, rotating and moving can be applied to these. The Android application features additional 'assistive drawing tools' which include a handwriting, shape and drawing recognition.

The Jamboard web and phone applications do not, however, allow sharing of audio or video; we therefore paired their use with a concomitant Zoom (Zoom Video Communications Inc, San Jose, CA, USA), Blackboard Collaborate (Blackboard Inc., Washington D.C.), or Microsoft Teams (Microsoft Corp., Redmond, WA) videoconference. This allowed the educator to communicate instructions to participants and for students to interact with each other.

TABLE 1 Advantages and limitations of Google Jamboard

Advantages	Limitations
Free to use.	A maximum of 20 slides per Jamboard
Many participants may edit the same slide or different slides at one time. Marks and text appear in almost real time.	A maximum of 50 collaborators can edit simultaneously. In practice, no more than 6–7 editing collaborators is recommended per slide at one time.
Can be accessed via a browser on a laptop, tablet or phone, or via the Jamboard phone/tablet application.	Relies on an active internet connection.
No login/registration required of students if Jamboard is created by the instructor.	Instructors must create a free Google account to initially create the Jamboard.
Editors may be anonymous which can encourage shy participants.	Anonymity may also be undesirable in some situations. If participants login with a Google account attribution is visible during live editing.
Jamboard saves all edits automatically to the cloud and these are accessible via Google Drive. It is also possible to export an entire Jamboard as a PDF file as a study aid or record of the session.	When using Jamboard as described in this article there is no facility for audio communication so a simultaneous meeting software such as Microsoft Teams or Zoom is necessary for simultaneous verbal discussion.
Possible to duplicate Jamboard for multiple uses.	Duplication of Jamboards for larger numbers of groups may be time consuming.
Ease of use.	The cognitive load on students due to familiarising themselves with another online platform.
Student autonomy: students have freedom to contribute using any tool and to move between slides.	Student autonomy: students may also change or delete parts of the Jamboard slides in an undesired way.

A summary of the pros and cons of this software can be found in Table 1.

The purpose of this toolbox article is to share recommendations for using a Jamboard-based approach. Our recommendations have been informed by our experiences implementing this initiative at three institutions to deliver anatomy teaching at undergraduate and postgraduate levels during the COVID-19 pandemic. The authors initially collaborated on exploring the potential uses of the tool and then individually refined an approach to best suit their specific cohorts. The differences in approach are illustrated in the case descriptions below (Box. 1-3). Ongoing conversations between the authors helped to further develop approaches through the sharing of feedback. The 'lessons learned' from these conversations and shared experiences are outlined below.

A scaffolded approach was implemented, which contrasts with the autonomous approach.

Used when students are more familiar with the material.

Allowed for seamless facilitation of all groups and stimulation of discussion, encouraging students to justify their work and develop reasoning.

Online adaptations tended to require less time than in-person sessions.

Allowing for an efficient continuation of their anatomy education.

Define the underpinning pedagogy

Whenever implementing a novel teaching tool, it is best to first consider how it will fit within the paradigm of established pedological

BOX 1 Queen's University Belfast (QUB)

At QUB, Jamboard was used with 18 gross anatomy students. Pre-pandemic, students carried out dissection and collaborative activities using large touchscreens in groups, so we aimed to recapitulate these interactions online. A scaffolded approach was implemented, which contrasts with the autonomous approach that can be used when students are more familiar with the material.[6] Slides were pre-populated with diagrams/photographs accompanied by questions or arrows (Figure 1A). During the session, groups of six students joined a Microsoft Teams meeting with their demonstrator and the Jamboard link was shared. Students signed the first slide, and they were each assigned a number, they were then directed when to move to each slide where they would answer correspondingly numbered questions. For each slide, the demonstrator offers feedback and positive reinforcement; this, as well as clearly defined roles and communication etiquette, is paramount to effective collaborative online interactions.[7] For review sessions, students were sent the Jamboard (as a PDF) in advance and told that they will be asked to annotate and present a randomly chosen side to their peers. This represents an online translation of peer teaching, which is often used in anatomy education as it allows students to reinforce their own understanding and develop their communication skills. Students tended to explain concepts to their peers using language and expression that accorded with the cohort's knowledge level, this phenomenon of 'cognitive congruence' has been ascribed to partially explain the successes of peer teaching in medical education.[8] Online sessions averaged 1.5–2 hours, which is less than in-person practicals (3 hours) and this was partially due to the exclusion of dissection. In module feedback, almost half of students responded that Jamboard practicals were what they enjoyed most about the module and they commended the interactivity of the sessions.

BOX 2 University of Dundee (UoD)

Third-year undergraduate medical students at UoD engaged in an applied radiology and surface anatomy workshop using Jamboard. Typically, these sessions utilise body-painting and clinical case scenarios, which was prevented by the COVID-19 pandemic. The goal was to further contextualise their understanding of anatomical concepts and apply it to radiology and clinical scenarios. Unlike at QUB, the students had undertaken all formal learning of integrated basic science material; therefore, no new information was presented during the session. Students were expected to recall and source relevant information to apply concepts to surface anatomy and radiographic imaging. These sessions consisted of 25 students divided into six groups, tasked with using Jamboard and Blackboard Collaborate to construct a 5-minute presentation on specific concepts. During a session, a single Jamboard was created, of which each group was assigned a set of three slides to populate. The first of each set had three or four learning outcomes which the students were tasked with presenting to the other groups. All group members could collaborate and edit the slides simultaneously. Following an hour of preparation time, the presentations were delivered via Blackboard Collaborate, after which tutors and students could discuss elements of the material. An exemplar slide from a student presentation is provided in Figure 1B. Jamboard allowed students to effortlessly develop, annotate and collaborate on the virtual task. It also allowed for seamless facilitation of all groups and stimulation of discussion, encouraging students to justify their work and develop reasoning for their decisions. The groups autonomously assigned roles and discussed the material, while drawing on their collective recall of concepts and devising strategies for addressing any knowledge gaps. They demonstrated rapid comprehension of the platform and an awareness of appropriate verbal communication when working virtually, echoing QUB's experience.

theory. Medical education, particularly anatomy, is facilitated by engagement in collaborative learning experiences. Social learning is the beating heart of these experiences and it is the role of the educator to facilitate them, allowing students to take a central role in their education. Our approach when designing and implementing Jamboard-based learning experiences was grounded in educational theories of experiential and social learning. Kolb's cycle of experiential learning advocates the use of reflection and interpretation of learning experiences to acquire new knowledge that can be applied in the future.[6] Therefore, the development of appropriate experiences with opportunities to reflect are key elements of learning environments in medical education. The theories of Vygotsky and other social constructivists can further inform the teaching approach and encourage the reflection process. Implementation of these concepts can promote student comprehension through the help of more knowledgeable peers or instructors.[6] Therefore, it is the role of the educator to develop environments which echo appropriate educational theories in practice.

1 | GET ACQUAINTED WITH THE PLATFORM

Prior to deployment, instructors and students should spend time becoming familiar with the basic functionality of the platform.

BOX 3 Lincoln Memorial University (LMU)

Unlike QUB and UoD, LMU permitted in-person gross anatomy labs for first-year medical students through the pandemic. Instructors and students were sequestered to one of four pods for the duration of the course in order to keep within social distancing guidelines. After a known exposure to the coronavirus in one such pod, six students were driven into a 14-day quarantine. We offered online anatomy laboratory sessions for the sequestered students in an effort to maintain a synchronous laboratory curriculum. Synchronicity was prioritised based on previous findings that online synchronous instruction promoted a greater degree of concentration while maintaining overall student satisfaction.[9] Google Jamboard was selected as the primary instrument due to its ability to seamlessly accommodate small group, collaborative sessions, mirroring the face-to-face experience to which students were accustomed. The face lab was adapted to one such Jamboard session. Here, pairs of students were assigned one of three sets of learning outcomes and tasked with collaboratively labelling structures on cadaveric images and answering open-ended questions. For example, one team answered questions related to the injury, course and parasympathetic function of the facial nerve, while labelling its various branches on cadaveric images (Figure 1C). Students communicated over Zoom through either the microphone or chat features. Lessons ended with the instructor revisiting each exercise with all students, providing elaborations or corrections where appropriate. More oversight was required compared to UoD as these students were not as advanced in their medical education. Jamboard provided an interactive platform that allowed students to engage with the material, and with one another, in a way that is inherently infeasible in a traditional didactic session. Further, online adaptations tended to require less time than in-person sessions, much like QUB's experience, allowing for an efficient continuation of their anatomy education.

Accessing, editing, and downloading privileges are particularly relevant for the instructor. Editing privileges can be granted either to specific users by entering individual email addresses, or by selecting the option 'anyone on the internet with this link can edit.' For the latter option, Jamboard links should be shared sensibly. Such settings can be changed in real time in the event students interfere with the learning process through unwarranted editing or deleting of content. We found it beneficial to limit editing capabilities following the session to prevent any possible alterations post-presentation. It is important that students are given an adequate introductory session demonstrating the tools and guidelines for online etiquette. It should be made clear that any text/marks they make are visible to anyone with which the Jamboard is shared. This introductory session should ideally be done before editor links are shared with students and could be delivered via a live screen share or recorded video.

2 | SESSION DESIGN

Upon reflection and discussions between authors, the design of individual Jamboards was considered in relation to the specific student cohorts across the institutions. When designing a Jamboard session, thought should be given to intended learning outcomes of the session which are appropriate for the level of students participating. A facilitated templated approach, where students followed a predesigned flow through the Jamboard, is suited for early-stage students meeting learning outcomes lower on Bloom's taxonomy. An autonomous approach, where students had free reign to use the full functionality of the Jamboard, was more appropriate for experienced cohorts or for student presentations. In facilitator-led sessions, the students should be able to hear and see the facilitator. This can be done via concomitant video conferencing platforms such as Zoom or Microsoft Teams. Ideally, students would share audio and video to fully participate, but sessions can be constructed that only require students to communicate using their interaction on the Jamboard. Timing of sessions was a matter of balancing the teaching contact hours and learning outcomes while being cognisant of 'zoom fatigue'. It should be considered that sessions with increased Jamboard interactivity may take longer than equivalent tasks in person. In our experience, an upper limit for the duration of facilitator-led sessions is two hours, but the ideal timing of sessions will vary depending on the task and format.

3 | HAVE CLEAR ROLES AND TASKS FOR DEMONSTRATOR AND STUDENT

If an instructor is present, their role may be that of a demonstrator directing students to their tasks, then providing feedback or corrections when students have marked up the document. Ideally, as this is a recapitulation of a practical session, the role should be one of facilitation rather than didacticism. If you feel that a demonstrator may benefit from an explanatory slide, this can be placed in the corner of the slide and minimised; following students' attempts at answering the question, this can be enlarged. The duties of the students should be made clear, this can be done through clear instructions on the slides or via the demonstrator. An easy way to accomplish the latter is to assign a number to each student and indicate that they should answer correspondingly numbered questions on each slide or address tasks on a correspondingly numbered slide of the Jamboard.

4 | INCLUSIVITY AND ACCESS

Jamboard provides an inclusive option for students who cannot share their audio or who may not have a quiet space to verbally participate in sessions, for example, if they are in a library or a shared space. Students can also participate using the tablet/smartphone app which provides further accessibility to students without adequate computing facilities. All authors found that the frequency of student interactions was higher when using Jamboard compared to screen sharing and asking questions verbally on Microsoft Teams. Regarding those students with poor Internet access, one lesson learned through feedback is to allow adequate time for marking up of the Jamboard, as these students may experience a lag of several seconds. The completed Jamboard or the blank original may be downloaded as a PDF and used for revision purposes or as a replacement assignment for students absent from the live session, respectively.

5 | TECHNICAL CONSIDERATIONS

We recommend that no more than six students should edit a slide simultaneously and templates should be simply designed so that subsequent mark-up and labels will not excessively overlap. If many structures are to be indicated on a slide, we would recommend the use of the laser tool instead of the pen tool as this leaves an impermanent mark that does not obscure the image for subsequent questions. Very few technical issues were experienced by the authors overall, but we found on rare occasions images do not load for students. This can be addressed by using the 'incognito' or private browsing mode on their browser or by using the tablet/smartphone application.

6 | LOOKING FORWARD

As we move closer to a post-pandemic world, we can take the lessons learned in the dramatic shift to online teaching and apply them to future practice. Given our experience as instructors over the COVID-19 pandemic, we see the benefits of digital tools to complement in-person instruction and will develop practices for its integration into post-pandemic teaching. Jamboard has proved its effectiveness as a tool for team-based learning interactions and presentations and this is no doubt transferable to in-person collaborations. It provides a free platform that is easily accessible and allows more equal participation than the traditional physical whiteboard or PowerPoint presentation.

As a result of accommodations made for COVID-19-related absences, it is likely that some degree of blended learning may now be expected by students at our institutions for any missed in-person teaching. At LMU, the utility of Jamboard to facilitate this purpose has been demonstrated and was well received by students and staff.

As the literature on virtual and blended learning experiences expands, we will explore how these educational practices can be adapted for Jamboard in areas like workshops, interactive review sessions and virtual laboratory options for students who are unable to participate in person.

CONCLUSION

The COVID-19 pandemic facilitated the boom in virtual learning approaches in medical education. This article presents the collective experiences and the lessons learned from using Jamboard internationally across three institutions amidst the pandemic. Jamboard allows educators the freedom to explore options in collaborative virtual education without the constraints of cost and restrictions of geographic location. This tool offers a versatile collaborative experience that can be repackaged for use in higher education and has additional potential within realms of interprofessional discussion such as research, professional development workshops or other creative environments. It offers a further element in a medical educator's toolbox which can be used to facilitate high-quality medical training at undergraduate and postgraduate levels.

This article presents the collective experiences and the lessons learned from using Jamboard internationally across three institutions amidst the pandemic.

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